

## **White Paper**

# **Summary of EPA Region 10 Guidance For Pacific Northwest State and Tribal Temperature Water Quality Standards**

Nevada Division of Environmental Protection

April 2015

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## ***Introduction***

EPA's current 304(a) criteria recommendations for temperature can be found in Quality Criteria for Water 1986, commonly known as the "gold book." The freshwater aquatic life criteria described in this 1986 document were first established in 1977, and were not changed in the 1986 document. For more information please refer to the Summary of EPA's Temperature Criteria Methodology Guidance Issue Paper.

In 1996, Oregon revised their water temperature standards and submitted it to EPA for approval. EPA approved in part and disapproved in part the Oregon temperature criteria in July 1999. This was because EPA, the National Marine Fisheries Service, and the US Fish and Wildlife Service reviewed the standards proposed by ODEQ and found several areas where they felt salmonids and other beneficial uses would not be adequately protected. To address these concerns, EPA Region 10 started an interagency project to develop regional temperature criteria guidance that would be protective of salmonids. The Washington Department of Ecology, Idaho Department of Environmental Quality, Oregon Department of Environmental Quality, National Marine Fisheries Service, U.S. Fish and Wildlife Service, and representatives of Pacific Northwest Tribes are all collaborated with EPA in this effort. The purpose of this effort was to guide states and tribes in the Pacific Northwest in developing their temperature standards, as required by the Clean Water Act.

Based on extensive review of the most recent scientific studies, EPA Region 10 and the Services believe that there are a variety of chronic and sub-lethal effects that are likely to occur to Pacific Northwest salmonid species exposed to the maximum weekly average temperatures calculated using the current 304(a) recommended formulas. Therefore, EPA Region 10 and the Services opted to not use current EPA 304(a) and instead developed criteria recommendations based upon multiple lines of evidence gathered from the available literature. The publication [EPA Region 10 Guidance For Pacific Northwest State and Tribal Temperature Water Quality Standards](#) was issued in April 2003. The recommended criteria are summarized in Tables 1 and 2. The following sections discuss these criteria and additional provisions in more detail.

**Table 1. Recommended Uses & Criteria That Apply To Summer Maximum Temperatures**

<b>Salmonid Uses During the Summer Maximum Conditions</b>	<b>Criteria</b>
Bull Trout Juvenile Rearing (generally in the upper portion of river basins)	12°C 7DADM
Salmon/Trout “Core” Juvenile Rearing (generally in the mid to upper part of river basins)  (Salmon adult holding prior to spawning, and adult and sub-adult bull trout foraging and migration may also be included in this use category)	16°C 7DADM
Salmon/Trout Migration plus Non-Core Juvenile Rearing (generally in the mid to upper part of river basins)	18°C 7DADM
Salmon/Trout Migration (generally in the lower part of a few river basins that likely reach this temperature naturally)	20°C 7DADM, plus a provision to protect and, where feasible restore the natural thermal regime

Notes: 1) “7DADM” refers to the Maximum 7 Day Average of the Daily Maximums;  
2) “Salmon” refers to Chinook, Coho, Sockeye, Pink, and Chum salmon;  
3) “Trout” refers to Steelhead and coastal cutthroat trout

**Table 2. Other Recommended Uses & Criteria**

<b>Salmonid Uses (generally during the fall-winter-spring period)</b>	<b>Criteria</b>
Bull Trout Spawning	9°C 7DADM
Salmon/Trout Spawning, Egg Incubation, and Fry Emergence	13°C 7DADM
Steelhead Smoltification	14°C 7DADM

Notes: 1) “7DADM” refers to the Maximum 7 Day Average of the Daily Maximums;  
2) “Salmon” refers to Chinook, Coho, Sockeye, Pink, and Chum salmon;  
3) “Trout” refers to Steelhead and coastal cutthroat trout

### ***Bull Trout Juvenile Rearing***

EPA recommends this use for the protection of moderate to high density summertime bull trout juvenile rearing near their natal streams in their first years of life prior to making downstream migrations. This use is generally found in a river basin’s upper reaches.

EPA recommends a 12°C maximum 7DADM criterion for this use to: (1) safely protect juvenile bull trout from lethal temperatures; (2) provide upper optimal conditions under limited food for juvenile growth during the period of summer maximum temperature and optimal temperature for other times of the growth season; (3) provide temperatures where juvenile bull trout are not at a competitive disadvantage with other salmonids; and (4) provide temperatures that are consistent with field studies showing where juvenile bull trout have the highest probability to occur.

EPA recommends that the spatial extent of this use include: (1) waters with degraded habitat where high and low density juvenile bull trout rearing currently occurs or is suspected to currently occur during the period of maximum summer temperatures, except for isolated patches of a few fish that are spatially disconnected from more continuous upstream low density use; (2) waters with minimally-degraded habitat where moderate to high density bull trout rearing currently occurs or is suspected to currently occur during the period of maximum summer temperatures; (3) waters where bull trout spawning currently occurs; (4) waters where juvenile rearing may occur and the current 7DADM temperature is 12°C or lower; and (5) waters where other information indicates the potential for moderate to high density bull trout rearing use during the period of maximum summer temperatures (e.g., recovery plans, bull trout spawning and rearing critical habitat designations, historical distributions, current distribution in reference streams, studies showing suitable rearing habitat that is currently blocked by barriers that can reasonably be modified to allow passage, or temperature modeling).

### ***Salmon/Trout “Core” Juvenile Rearing***

EPA recommends this use for the protection of moderate to high density summertime salmon and trout juvenile rearing. This use is generally found in a river basin’s mid-to-upper reaches, downstream from juvenile bull trout rearing areas. However, in colder climates, such as the Olympic mountains and the west slopes of the Cascades, it may be appropriate to designate this use all the way to the saltwater estuary.

Protection of these waters for salmon and trout juvenile rearing also provides protection for adult spring chinook salmon that hold throughout the summer prior to spawning and for migrating and foraging adult and sub-adult bull trout, which also frequently use these waters.

EPA recommends a 16°C maximum 7DADM criterion for this use to: (1) safely protect juvenile salmon and trout from lethal temperatures; (2) provide upper optimal conditions for juvenile growth under limited food during the period of summer maximum temperatures and optimal temperatures for other times of the growth season; (3) avoid temperatures where juvenile salmon and trout are at a competitive disadvantage with other fish; (4) protect against temperature-induced elevated disease rates; and (5) provide temperatures that studies show juvenile salmon and trout prefer and are found in high densities.

### ***Salmon/Trout Migration plus Non-Core Juvenile Rearing***

EPA recommends this use for the protection of migrating adult and juvenile salmonids and moderate to low density salmon and trout juvenile rearing during the period of summer maximum temperatures. This use designation recognizes the fact that salmon and trout juveniles will use waters that have a higher temperature than their optimal thermal range. For water bodies that are currently degraded, there is likely to be very limited current juvenile rearing during the period of maximum summer temperatures in these waters. However, there is likely to be more extensive current juvenile rearing use in these waters during other times of the year. Thus, for degraded waters, this use designation could indicate a potential rearing use during the period of summer maximum temperatures if maximum temperatures are reduced.

This use is generally found in the mid and lower part of a basin, downstream of the Salmon and Trout Core Juvenile Rearing use. In many river basins in the Pacific Northwest, it may be appropriate to designate this use all the way to a river basin’s terminus (i.e., confluence with the Columbia River or saltwater).

EPA recommends an 18°C maximum 7DADM criterion for this use to: (1) safely protect against lethal conditions for both juveniles and adults; (2) prevent migration blockage conditions for migrating adults; (3) provide optimal or near optimal juvenile growth conditions (under limited food conditions) for much of the summer, except during the summer maximum conditions, which would be warmer than optimal; and (4) prevent adults and juveniles from high disease risk and minimize the exposure time to temperatures that can lead to elevated disease rates.

The upstream extent of this use designation is largely driven by where the salmon and trout core juvenile rearing use (16°C) is defined. It may be appropriate to designate this use downstream to the basin's terminus, unless a salmon and trout migration use (20°C) is designated there. Generally, for degraded water bodies, this use should include waters where juvenile rearing currently occurs during the late spring-early summer and late summer-early fall, because those current uses could indicate potential use during the period of summer maximum temperatures if temperatures were to be reduced.

### ***Salmon/Trout Migration***

EPA recommends this use for waterbodies that are used almost exclusively for migrating salmon and trout during the period of summer maximum temperatures. Some isolated salmon and trout juvenile rearing may occur in these waters during the period of summer maximum temperatures, but when it does, such rearing is usually found only in the confluence of colder tributaries or other areas of colder waters. Further, in these waters, juvenile rearing was likely to have been mainly in cold water refugia areas during the period of maximum temperatures prior to human alteration of the landscape. It should also be noted that most fish migrating in these waters do so in the spring-early summer or in the fall when temperatures are cooler than the summer maximum temperatures, but some species (e.g., late migrating juvenile fall chinook; adult summer chinook, fall chinook, summer steelhead, and sockeye) may migrate in these waters during the period of summer maximum temperatures.

This use is probably best suited to the lower part of major rivers in the Pacific Northwest, where based on best available scientific information, it appears that the natural background maximum temperatures likely reached 20°C. When designating the spatial extent of this use, EPA expects the State or Tribe to provide information that suggests that natural background maximum temperatures reached 20°C. However, EPA does not expect the State or Tribe to have conducted a process-based temperature model.

To protect this use, EPA recommends a 20°C maximum 7DADM numeric criterion plus a narrative provision that would require the protection, and where feasible, the restoration of the natural thermal regime. EPA believes that a 20°C criterion would protect migrating juveniles and adults from lethal temperatures and would prevent migration blockage conditions. However, EPA is concerned that rivers with significant hydrologic alterations (e.g., rivers with dams and reservoirs, water withdrawals, and/or significant river channelization) may experience a loss of temperature diversity in the river, such that maximum temperatures occur for an extended period of time and there is little cold water refugia available for fish to escape maximum temperatures. In this case, even if the river meets a 20°C criterion for maximum temperatures, the duration of exposure to 20°C temperatures may cause adverse effects in the form of increased disease and decreased swimming performance in adults, and increased disease, impaired smoltification, reduced growth, and increased predation for late emigrating juveniles (e.g., fall chinook in the Columbia and Snake Rivers). Therefore, in order to protect this use with a 20°C criterion, it may be necessary for a State or Tribe to supplement the numeric criterion with a narrative provision to protect and, where feasible, restore the natural thermal regime for rivers with significant hydrologic alterations.

### ***Bull Trout Spawning***

EPA recommends this use for the protection of waterbodies used or potentially used by bull trout for spawning, which generally occurs in the late summer-fall in the upper basins (the same waters that bull trout juveniles use for summer rearing). EPA recommends a 9°C maximum 7DADM criterion for this use and recommends that the use apply from the average date that spawning begins to the average date incubation ends (the first 7DADM is calculated 1 week after the average date that spawning begins). Meeting this criterion at the onset of spawning will likely provide protective temperatures for egg incubation (2 - 6°C) that occurs over the winter assuming the typical annual thermal pattern.

### ***Salmon/Trout Spawning, Egg Incubation, and Fry Emergence***

EPA recommends this use for the protection of waterbodies used or potentially used for salmon and trout spawning, egg incubation, and fry emergence. Generally, this use occurs: (a) in spring-early summer for trout (mid-upper reaches); (b) in late summer-fall for spring chinook (midupper reaches) and summer chum (lower reaches); and (c) in the fall for coho (mid-reaches), pink, chum, and fall chinook (the latter three in lower reaches). EPA recommends a 13°C maximum 7DADM criterion to protect these life stage uses for salmon and trout and recommends that this use apply from the average date that spawning begins to the average date incubation ends (the first 7DADM is calculated 1 week after the average date that spawning begins). Meeting this criterion at the onset of spawning for salmon and at the end of incubation for steelhead trout will likely provide protective temperatures for egg incubation (6 - 10°C) that occurs over the winter (salmon) and spring (trout), assuming the typical annual thermal pattern.

### ***Steelhead Trout Smoltification***

EPA recommends this use for the protection of waters where and when the early stages of steelhead trout smoltification occurs or may occur. Generally, this use occurs in April and May as steelhead trout make their migration to the ocean. EPA recommends a 14°C maximum 7DADM steelhead smoltification criterion to protect this sensitive use. Steelhead smoltification can be impaired from exposure to greater than 12°C constant temperatures. The greatest risk to steelhead is during the early stages of smoltification that occurs in the spring (April and May). For the Columbia River tributaries, 90% of the steelhead smolts are typically past Bonneville dam by the end of May, indicating that applying this criterion at the mouths of major tributaries to the Columbia River in April and May will likely protect this use. Applying this criterion to the Columbia River itself is probably unnecessary because the more temperature-sensitive early stages of smoltification occur in the tributaries. If steelhead in the early smoltification process are exposed to higher temperatures than the recommended criterion, they may cease migration or they may migrate to the ocean undeveloped, thereby reducing their estuary and ocean survival.

### ***Provisions to Protect Water Temperatures that are Currently Colder than the Numeric Criteria***

EPA recommends that States and Tribes adopt strong regulatory provisions to protect waterbodies with ESA-listed salmonids that currently have summer maximum temperatures colder than the State's or Tribe's numeric criteria. EPA believes there are several ways a State or Tribe may do this. One approach could be to adopt a narrative temperature criterion (or alternatively include language in its antidegradation rules) that explicitly prohibits more than a de minimis increase to summer maximum temperatures in waters with ESA-listed salmonids that are currently colder than the summer maximum numeric criteria. Another approach could be to identify and designate waterbodies as ecologically significant for temperature and either establish site-specific numeric criteria equal to the current temperatures or prohibit temperature increases above a de minimis level in these waters. States and Tribes following this latter approach should conduct a broad survey to identify and designate such waters within the state (or tribal lands). For non-summer periods it may be appropriate to set a maximum allowable increase (e.g., 25% of the difference between the current temperature and the criterion) for waters with ESA-listed salmonids where temperatures are currently lower than the criteria.

### ***Provision for Unusually Warm Conditions***

One possible way for a State or Tribe to do create a provision for unusually warm conditions would be to explain in its WQS that it will determine attainment with the numeric temperature criterion based on the 90th percentile of the yearly maximum 7DADM values calculated from a yearly set of values of 10 years or more. Thus, generally speaking, the numeric criteria would apply 9 out of 10 years, or all but the hottest year. Another way may be to exclude water temperature data when the air temperature during the warmest week of the year exceeds the 90th percentile for the warmest week of the year based on a historical record (10 years or more) at the nearest weather reporting station.

### ***Provisions for Natural Background***

A State and Tribe may wish to consider adopting narrative natural background provisions in its WQS that would automatically take precedence over the otherwise applicable numeric criteria when natural background temperatures are higher than the numeric criteria.

### ***A De Minimis Temperature Increase Allowance***

A State or Tribe may, if it has not already done so, wish to consider adopting a provision in its WQS that allows for a de minimis temperature increase above the numeric criteria or the natural background temperature. A State or Tribe might choose to include a de minimis increase allowance as a way of accounting for monitoring measurement error and tolerating negligible human impacts. The data and information currently available to EPA appear to indicate that an increase on the order of 0.25°C for all sources cumulatively (at the point of maximum impact) above fully protective numeric criteria or natural background temperatures would not impair the designated uses, and therefore might be regarded as de minimis.

### ***Conclusions***

The April 2003 publication [EPA Region 10 Guidance For Pacific Northwest State and Tribal Temperature Water Quality Standards](#) is not a great overall model for Nevada to use as a template

because its recommendations are largely driven by anadromous fish. The guidance specifically addresses the following coldwater salmonid species in the Pacific Northwest: chinook, coho, sockeye, chum, and pink salmon; steelhead and coastal cutthroat trout; and bull trout. However, certain portions of guidance should be helpful in developing Nevada's temperature criteria such as:

- EPA Region 10's recommended criteria for bull trout rearing (12°C 7DADM);
- EPA Region 10's recommended criteria for bull trout spawning (9°C 7DADM);
- EPA Region 10's recommended Provisions to Protect Water Temperatures That Are Currently Colder Than the Numeric Criteria;
- EPA Region 10's recommended Provision for Unusually Warm Conditions;
- EPA Region 10's recommended Provisions for Natural Background Conditions; and
- EPA Region 10's recommendation for a De Minimis Temperature Increase Allowance.